ABoVE Standard Projection and Reference Grid

Justification

The ABoVE field campaign will provide the opportunity to expand and coordinate a set of focused, interdisciplinary research activities designed to further understand the causes and consequences of change in the social-ecological systems of the Arctic and boreal regions of western North America. The campaign is expected to result in the development of multiple geospatial datasets. To facilitate data interoperability, a standard projection and reference grid have been proposed to cover the ABoVE study domain.

The domain for the study area is over 6.3×10^6 km^2 as shown in the red and purple outlines in Figure 1. Thematic data products will be generated from field measurements, flux towers, airborne remote sensors and satellite remote sensing data. The datasets will range considerably in resolution, format, geographic extent, projection and/or reference system. This variability in ABoVE datasets is likely to place a considerable burden on individual researchers as they will need to standardize the incoming datasets to support geospatial analysis, thus leading to duplicated effort across research groups utilizing these products. This duplication of effort will continue to propagate as outcomes of scientific analysis from individual research groups will require subsequent standardization to support their further inclusion in ABoVE science projects. Implementing a standard projection and grid would enable the producers of the data to align and subdivide data products in order to ease archiving and distribution of datasets (both for long-term archiving of the data and near-term use throughout the campaign's duration), and would simplify data standardization for scientific analysis within ABoVE. This compatibility across multiple datasets will facilitate interoperability of the datasets in scientific analysis, and is an important benefit of the standardized projection and reference grid.

Additionally, it is expected that many data products will be generated with medium to fine resolution (30m spatial resolution or less) imagery and hence would be too large to distribute to users as single files covering the entire study region. Where the projection provides a mechanism to ensure that the products are geometrically compatible, the reference grid provides a standardized way to break the files up into units that are easy to download and manipulate by the researchers.

The approach taken here is modeled after the MODIS standard products. Below is a list of assumptions that were used when determining the projection and grid:

1. While the projection would be applicable to multiple data types, the grid would primarily be used for raster products produced over the study domain (not including circumpolar datasets).
2. To provide areal calculations from the data products we need to have the data in an equal area projection.
3. The products could range from fine spatial resolution (1 – 5m) to coarse spatial resolution (250m or more).
4. 30m will be a central spatial resolution.
5. Users of raster data can easily download files that are 300MB in size.

Standard Projection

The projection for use and archiving of geospatial data products for the ABoVE study domain is the Canada Albers Equal Area projection. This projection has been selected because it is equal area, is widely supported in geospatial software (ESRI, ENVI, gdal, etc), is commonly used for data products in this region, and has central meridian and parallels within the high northern latitude areas that are the focus of the ABoVE campaign.

Projection Specifications:

Canada_Albers_Equal_Area_Conic
WKID (EPSG): 102001 Authority: ESRI

Projection: Albers
False_Easting: 0.0
False_Northing: 0.0
Central_Meridian: -96.0
Standard_Parallel_1: 50.0
Standard_Parallel_2: 70.0
Latitude_Of_Origin: 40.0
Linear Unit: Meter (1.0)

Geographic Coordinate System: GCS_North_American_1983
Angular Unit: Degree (0.0174532925199433)
Prime Meridian: Greenwich (0.0)
Datum: North_American_1983
  Spheroid: GRS_1980
    Semimajor Axis: 6378137.0
    Semiminor Axis: 6356752.314140356
    Inverse Flattening: 298.257222101

Reference Grid

The proposed grid would be applicable mainly for raster-based products derived for the study domain (but would not apply to circumpolar datasets). The grid has been designed to cover the entire study domain, and extends to the eastern portions of North America (see Figure 1 below) to accommodate any products that are looking at continental scale processes. This grid is similar to the MODIS tiling scheme and is a nested pair of grids provided at scales of 240 and 30 meter spatial resolution, such that products from MODIS and Landsat would be compatible within the grid. It is easily scalable for products of 30, 60, 90 meters etc., although for products smaller than 15 meters, it may be necessary to subdivide the grid to keep file sizes manageable.

Gridded ABoVE datasets of the extent larger than 100X100 km^2 are to be produced in this grid and projection (this is roughly a Landsat tile). Also, we recognize that at very high resolution, reprojection of original data can result in substantial special shifts in orientation, location, and shape of small objects; therefore, science team members are encouraged to their submit fine-scale datasets in the original projection in addition to the ABoVE grid format (if the extent of their dataset is greater or equal to 10,000 km^2) or only in the original projection if it is smaller than that size.

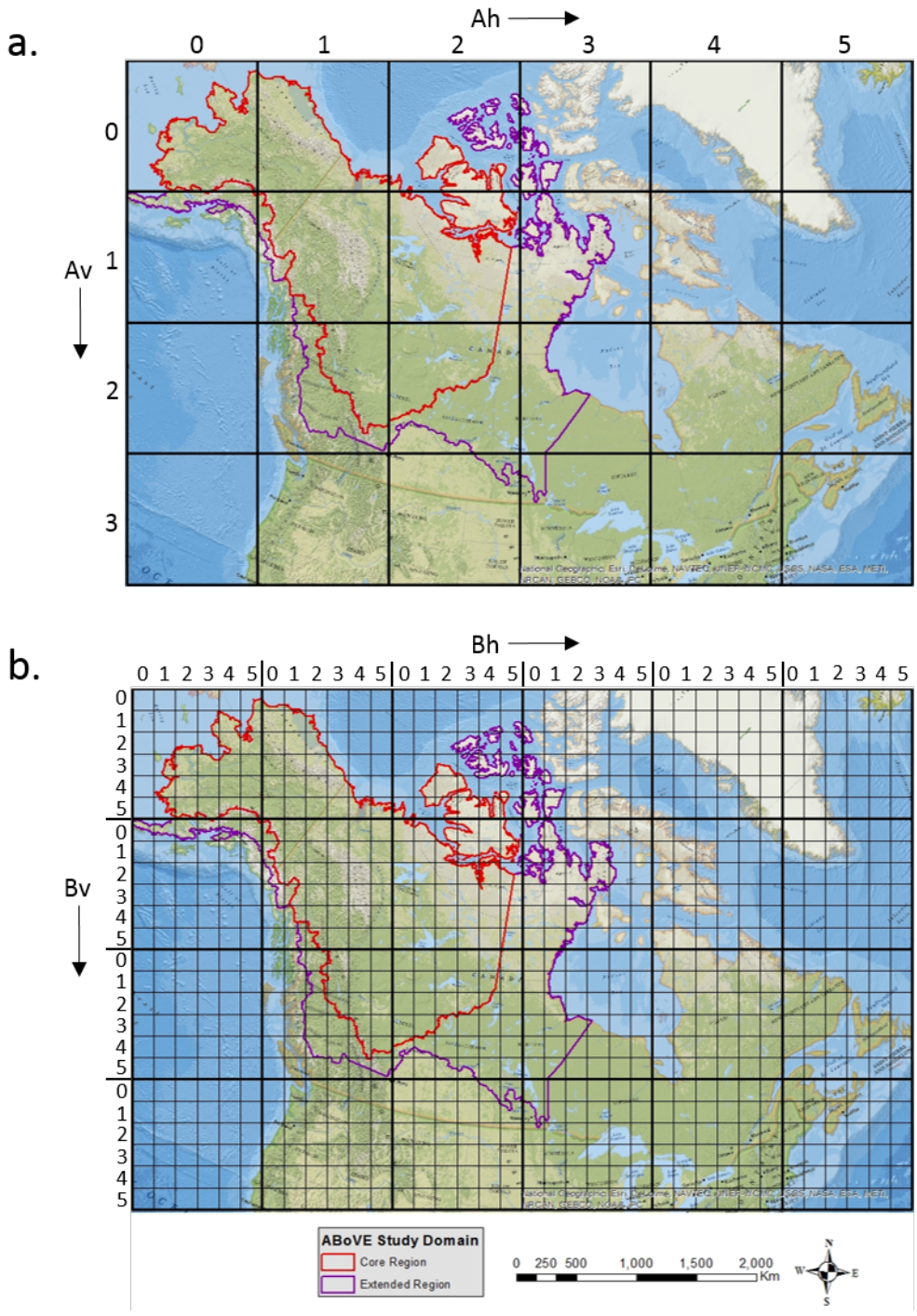


Figure 1. The ABoVE reference grid and study domain. a) The 240 m reference grid (4500 X 4500 grid cells per tile) with associated Ah and Av values and b) The 30 m reference grid (6000 X 6000 grid cells per tile) superimposed on the "A" grid.

Reference Grid Naming Convention

The reference grid naming convention is, again, modeled after the MODIS grid using horizontal (h) and vertical (v) offsets from the upper left corner to describe the tile. For example in Figure 1a (showing the large grid) the tile in the upper left corner is referred to as "h0v0" and the tile in the lower right corner is referred to as "h5v3". Figure 1b shows the smaller grid nested inside the larger grid. For each of the large tiles there is a series of small tiles nested inside. The large grid is referred to as "A" and the small grid is referred to as "B". This yields a naming convention such as:

ABoVE.water.2001001.Ah0v0.Bh2v3.001.2014075120101.hdf

Where:

ABoVE – refers to the campaign

Water – refers to the product ID or type

2001001 – refers to the data reference date

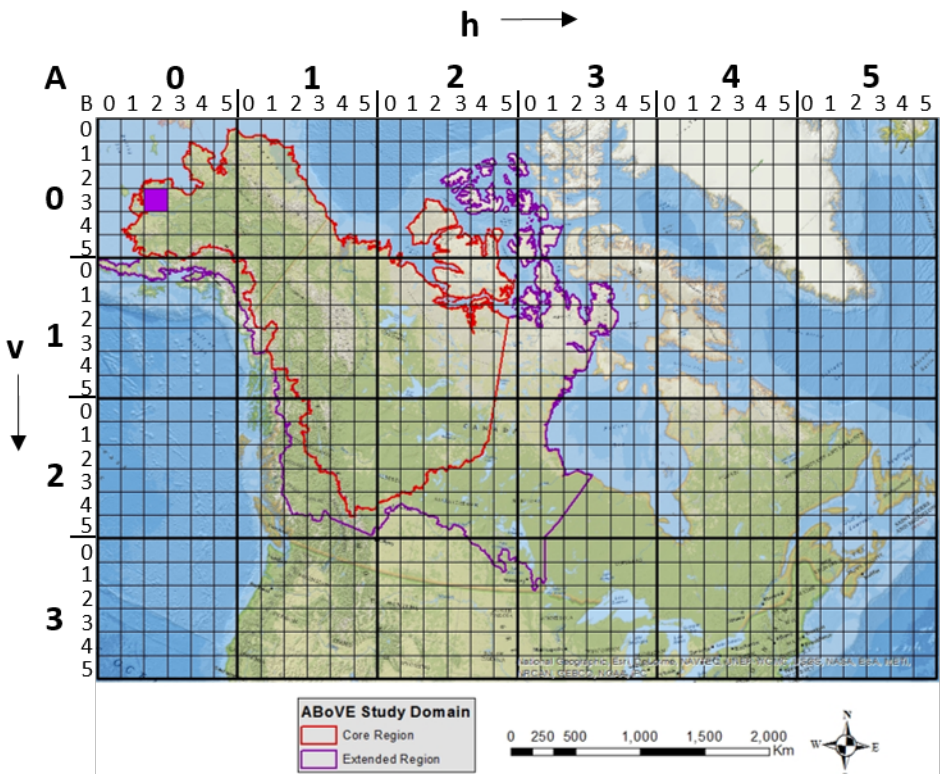
Ah0v0 – refers to the upper left tile in the "A" or larger grid

Bh2v3 – refers to the central tile in the "B" or smaller grid

001 – refers to the version of the product

2014075120101 – is a production date for the product

Figure 2. The location of sample tile Ah0v0.Bh2v3 (in purple) within both the larger "A" grid (in bold) and the smaller "B" grid.


h
v
A
B
0
1
2
3
4
5
ABoVE Study Domain
Core Region
Extended Region
0 250 500 1,000 1,500 2,000
Km
N
W
E